2nd International Indian Ocean Expedition 2015-2020

Newsletter

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(A basin-wide research program co-sponsored by IOC-UNESCO, SCOR and IOGOOS)

To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.

A New Partnership between Korea and the United States under IIOE-2

A new partnership between the Korea Institute of Ocean Science and Technology (KIOST) and the US National Oceanic and Atmospheric Administration (NOAA) has emerged under IIOE-2. Scientific planning for this partnership began with a workshop that was convened at Seoul National University, South Korea (29 Nov. – 1 Dec.) in 2017. The resulting science plan proposes to focus joint Korean and US research under IIOE-2 in the Seychelles-Chagos Thermocline Ridge (SCTR).

Participants at the workshop in Seoul, South Korea

This science plan (which can be downloaded from https://kiost-noaa-lab.wixsite.com/kudos2018/logistic-information) articulates a wide range of interdisciplinary research questions that will be pursued collaboratively by KIOST, NOAA and academic researchers in both countries. The KIOST-NOAA partnership plans to utilize a new all-purpose research vessel, the R/V Isabu, that was recently launched by KIOST. The R/V Isabu's maiden voyage to the Indian Ocean in 2017 successfully serviced moorings of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) in a pilot demonstration project of joint Korean-US cooperation. A second workshop will be convened at Scripps Institution of Oceanography in the USA on Nov. 6-8, 2018 with the goal of formulating specific joint Korean-US research plans and proposals.

[Report Courtesy: Raleigh R. Hood, *University of Maryland Center for Environmental Science, Cambridge, USA.]*

BoBBLE: Bay of Bengal Boundary Layer Experiment

The southern Bay of Bengal is a dynamically rich oceanic region, owing to the presence of several oceanographic features such as the summer monsoon current (SMC), Sri Lanka Dome (SLD), a cold pool, sub-surface high salinity core, a salt pump and chlorophyll blooms. The atmosphere above the bay, during the summer monsoon, is characterized by the formation of several cloud bands which move over to the land mass. A field experiment was carried out on board RV Sindhu Sadhana during 23 June to 24 July, 2016 into southern Bay of Bengal to collect high-quality in situ data sets of ocean, atmosphere and air-sea interaction. Physical, biological and chemical parameters were measured along the 8°N section (Figure-1) using a CTD, five gliders, a microstructure profiler, underwater radiometer, uCTD, ADCP, Argo floats

and drifting buoys. Air sea fluxes were measured using an automated weather station and an eddy co-variance system. Upper air was profiled using radiosondes. These observations provided multi-platform observations of features of the southern bay and captured a pre-conditioning phase of the summer monsoon.

P. N. Vinayachandran, Adrian J Matthews, K Vijay Kumar, Alejandra Sanchez-Franks, V Thushara, Jenson George, V Vijith, Benjamin GM Webber, Bastien Y Queste, Rajdeep Roy, Amit Sarkar, Dariusz B Baranowski, GS Bhat, Nicholas P Klingaman, Simon C Peatman, C Parida, Karen J Heywood, Robert Hall, Brian King, Elizabeth C Kent, Anoop A Nayak, CP Neema, P Amol, A Lotliker, A Kankonkar, DG Gracias, S Vernekar, AC D. Souza, G Valluvan, Shrikant M Pargaonkar, K Dinesh, Jack Giddings, Manoj Joshi, (2018) BoBBLE (Bay of Bengal Boundary Layer Experiment): Ocean–atmosphere interaction and its impact on the South Asian monsoon, Bull. Amer. Met. Soc., https://doi.org/10.1175/BAMS-D-16-0230.1 , August, 2018, 1569 – 1587.

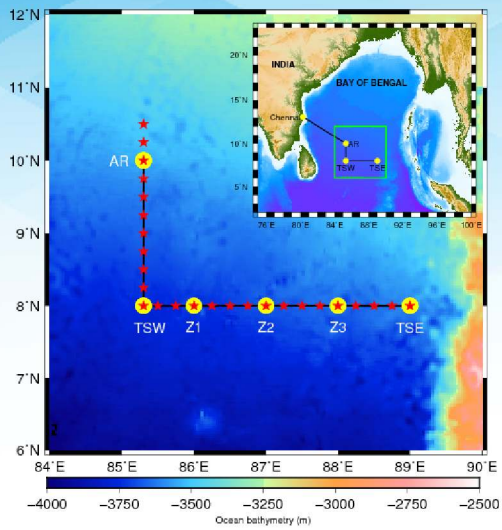

Figure-1. Cruise track of the BoBBLE field program. CTD stations are shown by red asterisk. Gliders were deployed at TSW, Z1, Z2, Z3 and TSE. In addition, profiling using radiometer, water sampling and Argo float deployments were also done at these locations. At TSE, time series of CTD profiles were measured from 4 – 15 July.

[Report Courtesy: P. N. Vinayachandran, *Centre for Atmospheric and Oceanic Sciences, IISc, India.]*

The Dynamics of the Southwest Monsoon Current in 2016 from High-Resolution In Situ Observations and Models

The Southwest (Summer) Monsoon supplies 80% of the annual rainfall to the Indian subcontinent, the population of which is heavily dependent on rainfall-fed subsistence agriculture. Variability in the monsoon rainfall is influenced by air-sea interactions within the Bay of Bengal (BoB). The strong stratification of the BoB causes rapid variations in sea surface temperature (SST) that influence the development of monsoon rainfall systems. This stratification is driven by the salinity difference between the fresh surface waters of the northern bay and the supply of warm, salty water by the Southwest Monsoon Current (SMC). Despite the influence of the SMC on monsoon dynamics, observations of this current during the monsoon are sparse.

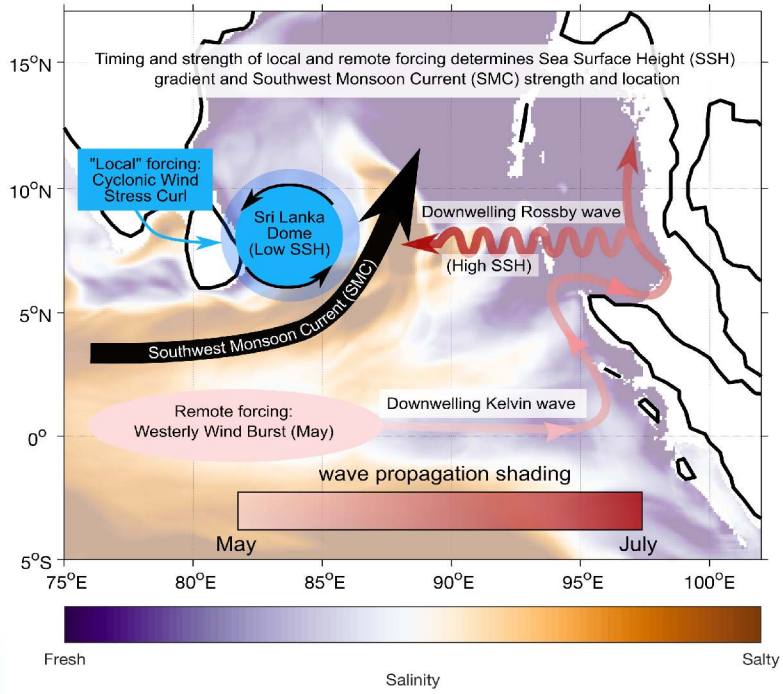

Figure-2. Schematic of the mechanisms governing the strength and location of the SMC.

During July 2016, The Bay of Bengal Boundary Layer Experiment (BoBBLE) campaign deployed a host of oceanographic platforms to observe the variability of the atmosphere and ocean during the monsoon. Measurements from ocean gliders and the ORV Sindhu Sadhana were used to quantify the strength of the SMC and the mechanisms underlying its variability. Using data from high-resolution in situ measurements along an east–west section at 8°N in the southern BoB, we calculate that the northward transport during July 2016 was between 16.7 and 24.5 Sv (1 Sv = 10^6 m^3 s^{-1}), although up to 2/3 of this transport is associated with persistent recirculating eddies, including the Sri Lanka Dome (Figure-2). Comparison with climatology suggests the SMC in early July was close to the average annual maximum strength. The NEMO 1/12° ocean model with data assimilation is found to faithfully represent the variability of the SMC and associated water masses. We show how the variability in SMC strength and position is driven by the complex interplay between local forcing (wind stress curl over the Sri Lanka Dome) and remote forcing (Kelvin and Rossby wave propagation).

Thus, various modes of climatic variability will influence SMC strength and location on time scales from weeks to years. Idealized one-dimensional ocean model experiments show that subsurface water masses advected by the SMC significantly alter the evolution of SST and salinity, potentially impacting Indian monsoon rainfall.

Webber, B. G. M., Matthews, A. J., Vinayachandran, P. N., Neema, C. P., Sanchez-Franks, A., Vijith, V., Amol, P. & Baranowski, D. B. (2018). The Dynamics of the Southwest Monsoon Current in 2016 from High-Resolution In Situ Observations and Models. J. Phys. Oceanogr. 48, 2259-2282. https://doi.org/10.1175/JPO-D-17-0215.1

[Report Courtesy: P. N. Vinayachandran, *Centre for Atmospheric and Oceanic Sciences, IISc, India.]*

Annual Meetings of the IIOE-2 Steering Committee, IOGOOS, IORP, SIBER, IRF & IOCINDIO 11-15 March 2019, South Africa

The IIOE-2 Joint Project office is pleased to report that through the agency of Prof Mike Roberts and associated colleagues of the West Indian Ocean SOLSTICE project (http://www.solstice-wio.org/) the Nelson Mandela University has offered to host the 3rd IIOE-2 Steering Committee meeting within the week of 11-15 March 2019, Port Elizabeth, South Africa. As in the past, this IIOE-2 meeting will be held under the banner of a 3rd International Indian Ocean Science Conference (IIOSC3), and incorporated collegially within an integrated week's schedule with IOGOOS-15, IORP-15, SIBER-9, IRF-9 and IOCINDIO-7. This is an early notice and further information (such as exact scheduling of the various meetings within the overall 5 day period of 11-15 March 2019) will be conveyed as the JPO undertakes planning with Nelson Mandela University and Prof. Michael Roberts.

IOGOOS - Indian Ocean Global Ocean Observing System (a GOOS Regional Alliance) ; IORP – Indian Ocean Region Panel of CLIVAR/IOC-GOOS ; SIBER – Sustained Indian Ocean Biogeochemistry and Ecosystem Research; IRF – Indian Ocean Observing System Resources Forum of IOGOOS; IOCINDIO – IOC Regional Committee for the Central Indian Ocean

Some Upcoming Events

- SOLAS Open Science Conference during 21-25 April 2019, at Hokkaido University Conference Hall, Sapporo, Japan.
  https://www.confmanager.com/main.cfm?cid=2778
- "Ocean sustainability for the benefit of society: Understanding, challenges, and solutions", 17-21 June 2019, Brest, France. Call for Sessions and Workshops at the Second Open Science Conference of the Integrated Marine Biosphere Research (IMBeR) Project.
  http://www.imber.info/en/events/osc--imber-open-science-conference/osc-2019/2019-imber-open-science-conference
- 14th International Conference on Copepoda (ICOC) during 14-19 June 2020, at Kruger Park, South Africa.
  http://abevents.co.za/WEB_ICOC2020/index.html

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (November-end) issue of the IIOE-2 Newsletter. Contributions referring IIOE-2 endorsed projects, cruises, conferences, workshops, "plain language summary" of published papers focused on the Indian Ocean etc. are welcome. Articles may be up to 500 words in length (Word files) accompanied by suitable figures, photos.(separate.jpg files).

Deadline: **25 November, 2018**

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IOGOOS GLOBAL OCEAN OBSERVING SYSTEM FOR INDIAN OCEAN

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

International Council for Science SCOR Scientific Committee on Oceanic Research